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Preliminary Results of Norwegian Blue
Whiting Survey Northwest of Scotland
in April 1979

by

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Abstract

A brief report is given on the result from an acoustic survey with the R/V "Michael Sars" to the blue whiting spawning area in second half of April 1979.

Rather dense concentrations of blue whiting were found from west of Scotland to the Faroes. Length- and age- composition are given. The majority of the stock consisted of 3 - 8 year old fish. Length-weight relationship is found to be different from previous years, and half of the stock was either ripe or spent.

A rough and preliminary figure of 4 mill. tonnes was calculated.

Introduction

The norwegian directed fishery for blue whiting has developed rather sharply during the last few years. From March to May when the blue whiting stock congregates for spawning in the area west of the British Isles, 12 vessels landed 40 000 tonnes in 1977, 35 vessels landed 153 000 tonnes in 1978 and 50 vessels landed near 200 000 tonnes in 1979. In addition there is a mixed fishery in the North Sea where the by-catch of blue whiting increased from 20 000 tonnes in 1977 to 40 000 tonnes in 1978.

The size of the spawning stock in the period 1972-74 is estimated by Buzeta and Nakken (1975) to be in the order of 6 mill. tonnes. They analysed the results from the norwegian acoustic surveys in 1972 (Jákupsstovú and Midttun, 1972), in 1973 (Jákupsstovú, Olsen and Midttun, 1973) and in 1974 (Buzeta et. al. 1974). Only part of the spawning stock was measured in 1975 and 1976 which gave results of 1.8 and 3.1 mill. tonnes respectively (Jákupsstovú and Midttun, 1977). In 1977 Norway had no acoustic survey on the spawning grounds, but a scouting vessel operated in the area.

In order to study the blue whiting concentrations in the spawning period, the new research vessel "Michael Sars" undertook an acoustic survey from 18 April to 4 May 1979, with attempt to estimate the abundance in the area from west of Scotland to the Faroes.

Methods

The acoustic recordings were made with a Simrad 39 kHz echosounder, connected to a two channel integrator. The integrator worked mainly from 10 to 400 m depth, but this was varied in

correspondance with the location of the recordings. To avoid saturation the gain was set to 20 dB, and the values (mm deflection per nautical mile) were multiplied by 20 to be expressed as 40 dB-values.

The theoretical basis for acoustic abundance estimation is given by Forbes and Nakken (1972). The relation between fish density and integrator deflection is:

$$\rho = C M + b$$

where ρ is number of fish per unit sea surface (square nautical mile), M is the integrated echo intensity in mm per mile and C the coefficient of fish density that causes 1 mm deflection on the echo integrator. This depends on fish species and size. The constant b is a threshold density. For picturing the distribution and relative abundance the average integrator value per n.mile, over 5 n.mile, were slided for each 25 n.mile and mapped along the cruise track. For estimation of the abundance, the area with blue whiting recordings was divided into subareas of 0.5° latitude and 1° longitude size, and the mean integrator deflection per n.mile within each subarea used.

Due to difficult condition and great depth of the recordings, no opportunity was given to make any single fish counts for obtaining C -values. Therefore a probable fish density coefficient, calculated from the one obtained with R/V "G.O. Sars" in 1976 (Blindheim and Jákupsstovú, 1977) was used. However, yet there has been no ship to ship calibration between "Michael Sars" and "G.O. Sars", but from other ship to ship calibrations, a new relationship could be establish. This is preliminary, and based on relationships between "G.O. Sars" and "Johan Hjort" and between "Johan Hjort" and "Dr. Fridtjof Nansen" which has the same type of acoustic systems as that of "Michael Sars".

For identifying of the recordings and biological analysis both pelagic trawl and bottom trawl were used. Obtaining of hydrographical data were made by use of a CTD-sonde.

Results and discussion

Survey track with stations are shown in Fig. 1, and the hydrographical situation in the sea-surface and at 400 m depth in Figs. 2 and 3 respectively.

The area was covered from south to north, and blue whiting was recorded more or less continuously within a relative wide belt along the shelf up to southwest of Faroes. In Fig. 4 is given the distribution and relative fish density. During night time the blue whiting was scattered mostly between 250 and 500 m depth, while during daytime it congregated and gave echo recordings as a dense layer around 350 m depth. At some localities the concentrations of blue whiting were rather high, and the best one was in second half of April found in the area north of St. Kilda.

The stock migrated northwards, and the fishing vessels, that followed the best concentrations, were in first week of May operating at the shelf southwest of Faroes. While the majority of the stock, consisting of adult fish, was located outside the continental shelf at great depths, blue whiting was also recorded near and on the shelf. This part of the stock was a mixture of young and older fish. Fig. 5 give the length distributions in the samples from the shelf and from outside the shelf respectively. The total mean length in the samples was 29.9 cm. The age-compositions in samples from the same two areas, are shown in Fig. 6. The majority of the stock consisted of mostly 3 to 8 year old fish, with smaller contribution of all age-groups up to 16 years. On the shelf, 1 to 3 year old fish predominated in the recordings.

No immature fish were found in the samples from outside the shelf (Table 1) and more than half of the stock was ripe or spent. On the shelf, 15.6 % males and 31.0 % females were found to be immature.

Table 2 gives the mean weight of blue whiting in different length groups. These are lower than the weights given by Buzeta and Nakken (1975) for the years 1972-74.

The abundance within the area surveyed was estimated to be 3.9 mill. tonnes with a mean density of 138 tonnes/sq. n.m. (Fig. 7). This is a rather rough and preliminary estimate. Due to the time limit and bad weather conditions, only part of the planned area could be covered. In second half of April the stock had started to migrate northwards towards the Norwegian Sea, and the northern limit of the distribution was not located.

A probable density coefficient of 548 fish per mm per sq. n.mile was used. Based on the different ship to ship calibrations mentioned above, this is calculated from $C = 540$ fish pr. mm per sq. n.m. with a fish length of 28.63 cm, given by Blindheim and Jákupsstovú (1977).

Recalculation of the abundance will be done when the necessary data become available. However, theoretical there is little difference in the acoustic systems of "G.O. Sars" and "Michael Sars". They are equipped with the same type of echo sounder with same source level. A new estimate therefore most probably will be in the same order, i.e. 4 mill.tonnes.

References

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Table 1. Maturity in samples of blue whiting from
 A) the continental shelf and from B) outside the shelf.

Maturity	A		B	
	♂♂ %	♀♀ %	♂♂	♀♀
immature	15,6	31,0	0	0
maturing	7,1	25,3	5,2	38,6
ripe	10,2	9,9	35,4	22,7
spent	67,2	33,8	59,3	38,6

Table 2. Weight of blue whiting (g) and number (n) in different length-groups, April 1979.

Cm	18	20	22	24	26	28	30	32	34	36	38	40	42									
g	27	41	49	45	58	68	75	80	86	101	107	120	131	140	150	158	174	183	193	249	250	280
n	3	22	8	6	6	11	9	17	20	43	76	109	137	173	116	64	39	19	6	4	1	1

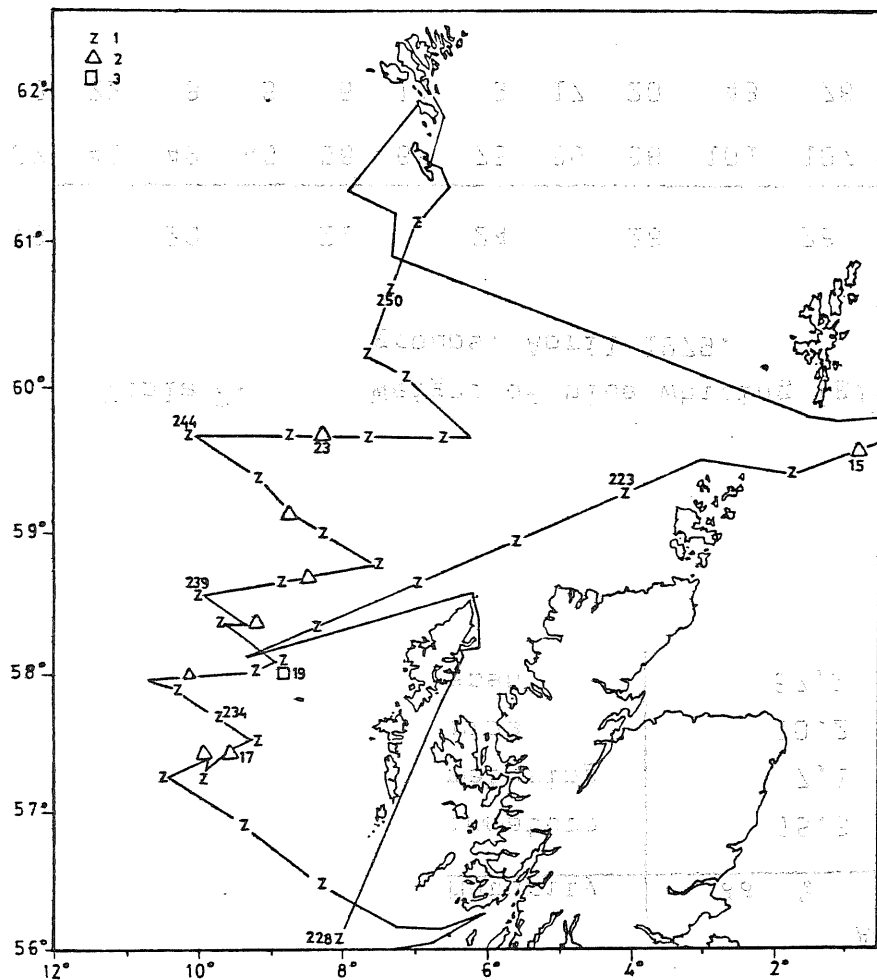


Fig. 1. Cruise track and stations with R/V "Michael Sars", 18 April to 4 May 1979. 1) Hydrographical stations with CTD-sonde, 2) Pelagic trawl stations, 3) Bottom trawl stations.

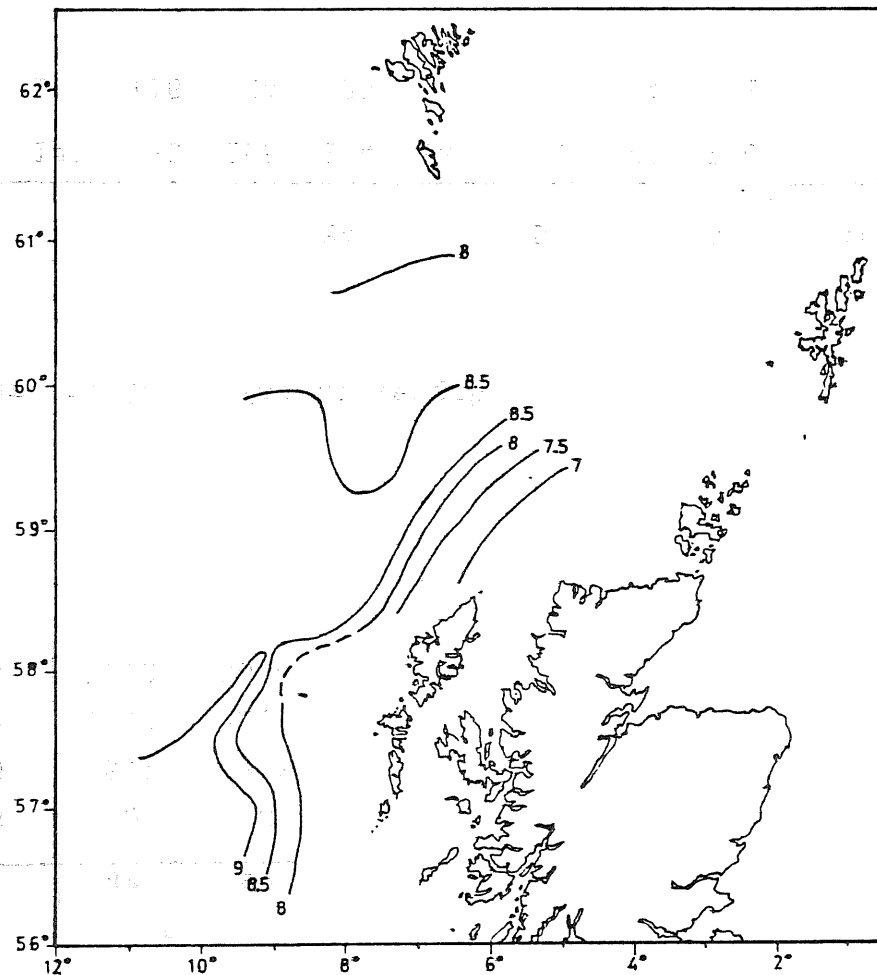


Fig. 2. Temperature, $t^{\circ}\text{C}$ at the surface.

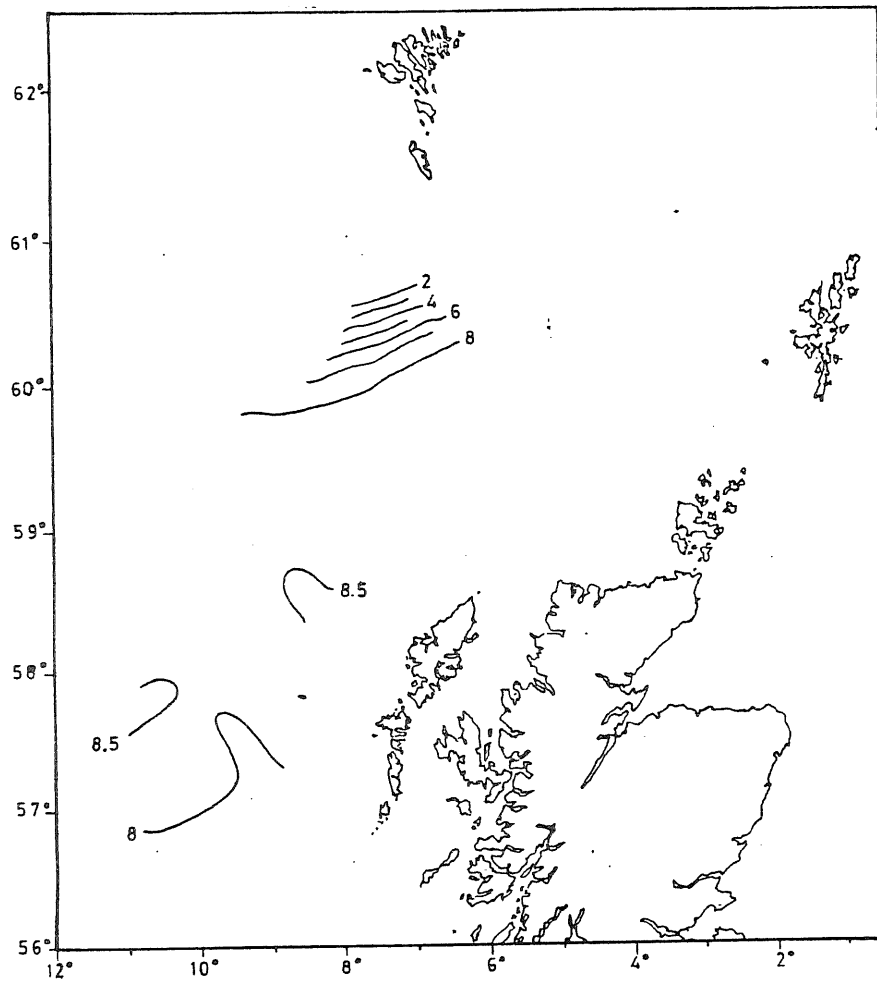


Fig. 3. Temperature, $t^{\circ}\text{C}$ at the bottom.

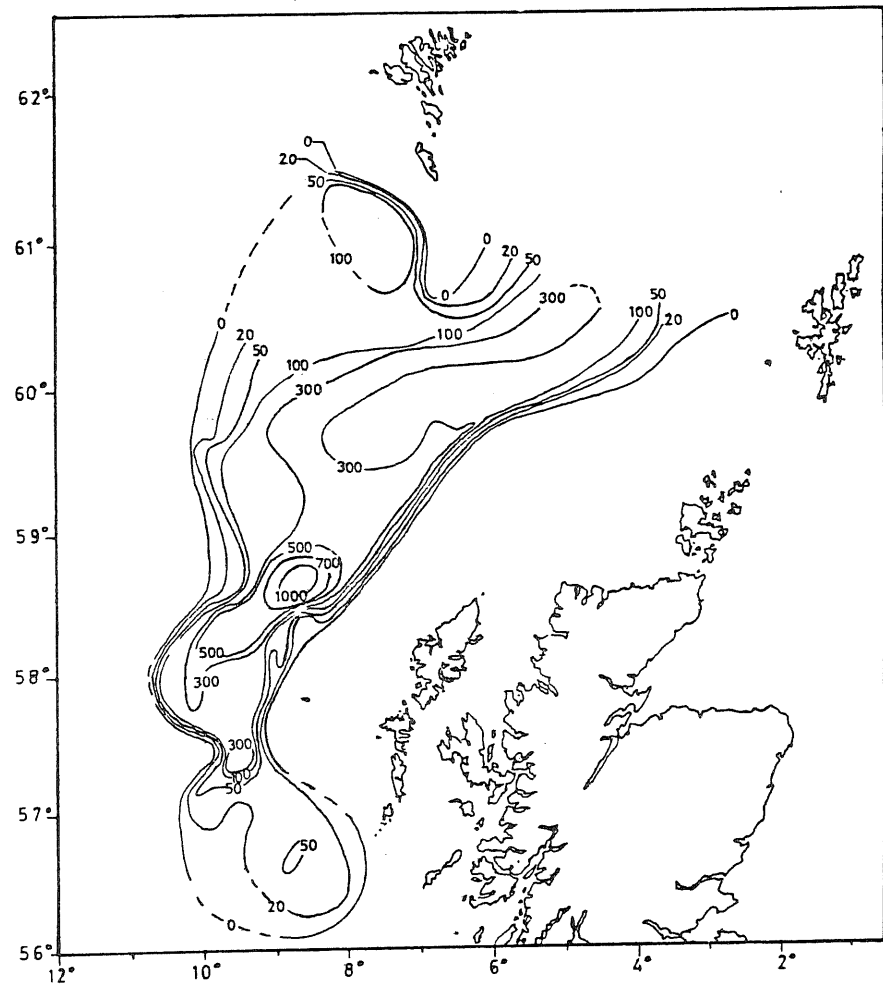


Fig. 4. Integrated echo intensity of blue whiting in cm pr. n.mile.

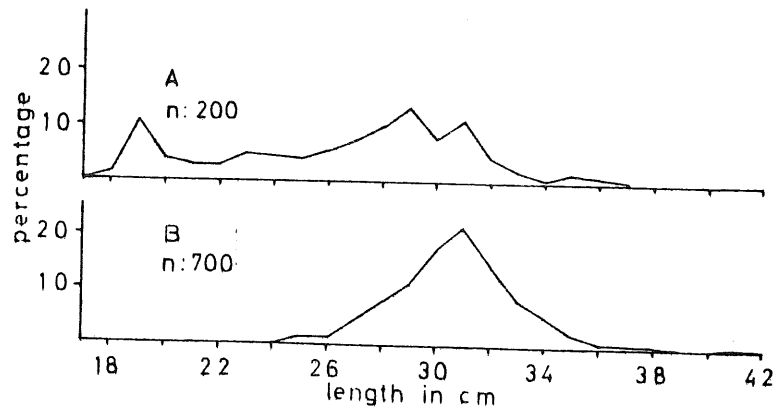


Fig. 5. Lengthfrequencies of blue whiting from A) the continental shelf and B) outside the shelf.

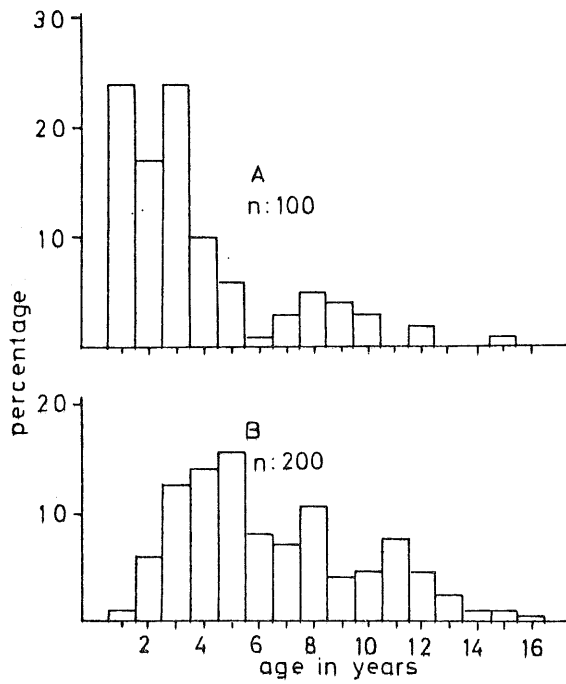


Fig. 6. Age-composition of blue whiting from A) the continental shelf and B) outside the shelf.

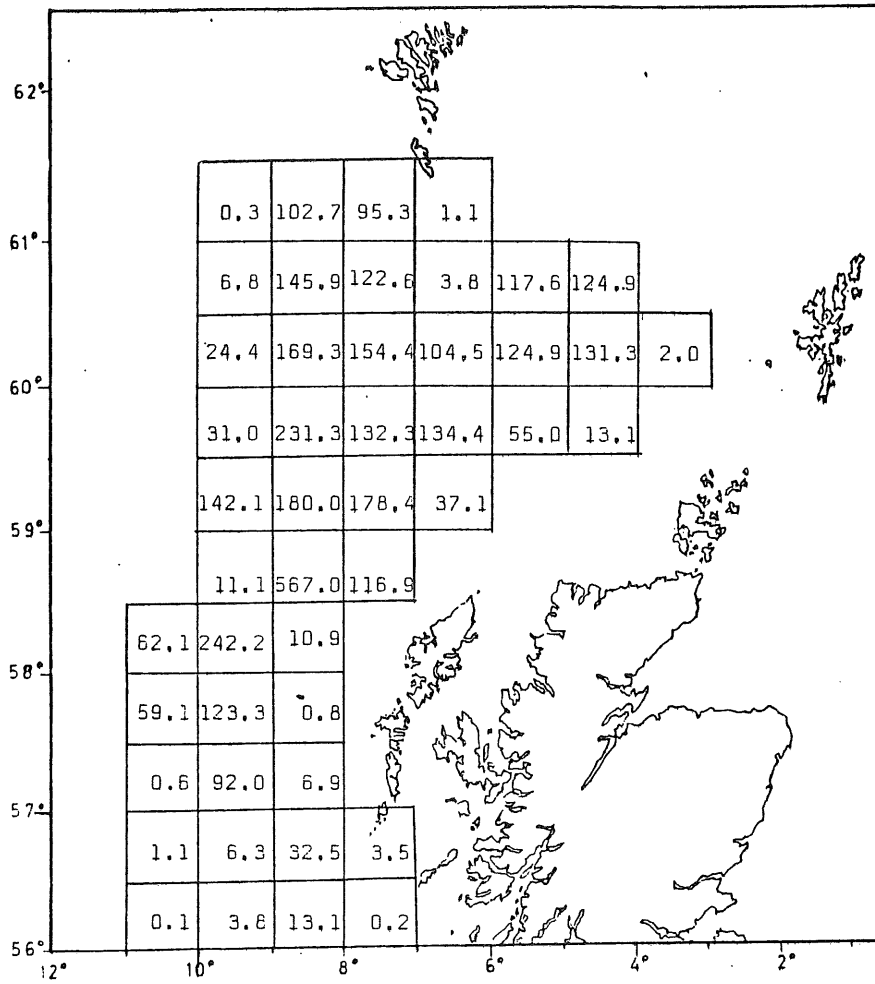


Fig. 7. Abundance of blue whiting in thousand tonnes.